LISTING OF CLAIMS

Claim 1 (Previously amended):   In a multicarrier communication system in which a signal

to be transmitted comprises data bits to be converted into a symbol modulated by each subcarrier

of the signal prior to transmission on a channel, a method for minimizing a peak to average

power ratio while minimizing introduction of errors into the signal to be transmitted, comprising:

sampling the symbols to be transmitted of a frame;

compare magnitudes of the samples of the frame to a predetermined threshold to

determine whether sample magnitudes in the frame violate the

predetermined threshold, the predetermined threshold being selectable to

control the number of samples violating the threshold;

responsive to determining a sample magnitude does violate the predetermined

threshold, applying a differentiable penalty function to the samples having

magnitudes exceeding the predetermined threshold;

computing a net penalty function value, the net penalty function value responsive

to the individual penalty function values computed for the samples having

magnitudes exceeding the predetermined threshold;

computing a gradient vector responsive to the net penalty function value;

determining a direction of the gradient vector;

determining an upper limit correction value for each symbol, the upper limit

correction value being selectable to control an amount of signal to noise

ratio deterioration;

applying a correction to the symbols to be transmitted in a direction opposite to

the direction of the gradient vector, the magnitude of the correction not

exceeding the determined correction values for each symbol; and

transmitting the corrected symbols to the channel.

Claim 2 (Previously amended):   The method of claim 1 wherein determining an upper limit

correction value for each symbol, further comprises:

computing an interpoint distance between symbols;

selecting a correction value for a symbol as a value less than the interpoint

distance to ensure that the symbol is not mistaken for other symbols.

Claim 3 (Original):   The method of claim 1 wherein applying a differentiable penalty function

to the samples having magnitudes exceeding the predetermined threshold comprises:

applying the function:

$$h(x[k]) = \begin{cases} (x[k] - T)^{2m} & if & x[k] \\ 0 & if & |x[k]| \\ (x[k] + T)^{2m} & if & x[k] \le \end{cases}$$

where m is a positive integer that decides the severity of penalty, T is the

predetermined threshold, x is the frame of data symbols expressed by: X =

$(r_0, r_1 \exp(j\theta_1), r_2 \exp(j\theta_2), ..., r_{N/2-1} \exp(j\theta_{N/2-1}), r_{N/2})$, where r_i and θ_i

denote the magnitude and phase of symbol in channel i, and k is the

number of the symbol.

Claim 4 (Original):   The method of claim 3 wherein the net penalty function comprises:

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$$f(x) = \sum_{k=0}^{N-1} h\big(x[k]\big)$$

Claim 5 (Original):   The method of claim 4, wherein the gradient vector is computed

as:

$$\frac{\partial f}{\partial r_i} = \sum_{k=0}^{N-1} \frac{dh(x[k])}{dx[k]} \cos\left(\frac{2\pi ki}{N} + \theta_i\right); i \in \{1,...,N/2-1\}$$

$$\frac{\partial f}{\partial r_0} = \sum_{k=0}^{N-1} \frac{dh(x[k])}{dx[k]}; \frac{\partial f}{\partial r_{N/2}} = \sum_{k=0}^{N-1} \frac{dh(x[k])}{dx[k]} \cos(\pi k)$$

$$\frac{\partial f}{\partial \theta_i} = -r_i \sum_{k=0}^{N-1} \frac{dh(x[k])}{dx[k]} \sin\left(\frac{2\pi ki}{N} + \theta_i\right); i \in \{1,...,N/2-1\}$$

Claim 6 (Original):   The method of claim 1 wherein the gradient vector is computed

only as a function of the magnitude of the sample values.

Claim 7 (Original):   The method of claim 1 wherein computing a net penalty function

value comprises adding together the individual penalty function values computed for the

samples having magnitudes exceeding the predetermined threshold to generate the net

penalty function value.

Claim 8 (Cancelled)

Claim 9 (Previously amended):   The method of claim 13 wherein computing a peak

reduction kernel responsive to the upper limit correction values comprises

determining a phase component and an amplitude component of the upper

limit correction values; and

setting the phase component of the upper limit correction values to zero to

ensure that the peak reduction kernel has its peak value at the first

sample of the frame.

Claim 10 (Previously amended):   The method of claim 13 wherein applying the peak

reduction kernel to the sample to reduce the peak of the sample comprises:

rotating the peak reduction kernel by an amount to ensure a peak of the

peak reduction kernel coincides with a peak of the frame;

determining whether the peak of the peak reduction kernel has a sign equal

to a sign of the peak of the frame;

responsive to the signs of the peaks of the peak reduction kernel and the

frame being equal, multiplying the peak reduction kernel by minus

one; and

adding the peak reduction kernel to the samples to reduce the peak of the

frame.

Claim 11 (Previously amended):   The method of claim 13 in a system in which more

than one peak may be present per frame, comprising the steps of:

responsive to determining that a sample magnitude exceeds the

predetermined threshold, applying the peak kernel to the sample,

wherein the peak kernel applied for each sample has a magnitude

scaled relative to an extent the sample magnitude exceeds the

predetermined threshold.

Claim 12 (Original): The method of claim 11 wherein the scaling factors are chosen to ensure a sum of the magnitudes of the kernels applied is equal to one.

Claim 13 (Currently amended): In a multicarrier communication system in which a signal to be transmitted comprises data bits to be converted into a symbol modulated by each subcarrier of the signal prior to transmission on a channel, for a signal having a single peak in a frame, a method for minimizing a peak to average power ratio while minimizing introduction of errors into the signal to be transmitted:

sampling the symbols to be transmitted of the frame;

comparing magnitudes of the samples of the frame to a predetermined threshold to determine whether sample magnitudes in the frame violate the predetermined threshold, the predetermined threshold being selectable to control the number of samples violating the threshold;

determining an upper limit correction value for each symbol, the upper limit correction value being selectable to control an amount of signal to noise ratio deterioration;

computing a peak reduction kernel responsive to the upper limit correction values;

responsive to determining a sample magnitude does violate the predetermined threshold, applying the peak reduction kernel to the sample to reduce the peak of the frame; and

transmitting the modified symbol to a receiver unaware of the method for mimimizing the peak to average power ratio.